Soil Characteristics Lab Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In this lab, you will examine the texture, structure, consistence, bulk density, capillary action, and permeability of various soil types and samples.

Day 1:

Purpose: To observe and describe the structure, consistence, and texture of clay and sand, and compare to a given sample.

Hypothesis: what type of soil do you think you have?

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Notes on:

* Texture -
* Structure (peds) -
* Consistence –

Materials:

* Clay
* Sand
* Assigned sample
* Spray bottle
* Paper toweling
* Ruler

Procedure:

1. Take a handful of soil and mist it with water.
2. Squeeze the soil. Does it form a ball? If no, add a little more water and try again. If still no, you have a sample of sand.
3. If the soil does form a ball, then perform the ribbon test.
   1. Hold a ball of soil in the crook of your forefinger.
   2. Push the soil over your finger using your thumb.
   3. Measure the length of the “ribbon”
   4. Start this test using the clay sample. It should make a ribbon that is at least 5 cm long
   5. If the sample did not form a ribbon, you have “loamy sand”
   6. If the ribbon is less than 2.5 cm long
      1. and the sample feels gritty, you have “sandy loam”
      2. and the sample feels smooth, you have “silty loam”
      3. there is no gritty or smooth feeling, you have “loam”
   7. If the ribbon is from 2.5 to 5cm long
      1. and the sample feels gritty, you have “sandy clay loam”
      2. and the sample feels smooth, you have “silty clay loam”
      3. and there is no definite gritty or smooth feeling, you have “clay loam”
   8. If the ribbon is more than 5cm long
      1. and feels gritty, you have “sandy clay”
      2. and feels smooth, you have “silty clay”
      3. and feels neither gritty nor smooth, you have “clay”
   9. Record all measurements and textures

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| --- | --- | --- | --- |
| Soil Sample | Ribbon length | Feel | Soil type |
| Clay |  |  | clay |
| Sand |  |  | sand |
| Outside sample ?? |  |  |  |

* 1. Test your soil for consistence when it is dry, damp, and wet
     1. Squeeze the soil until it breaks apart. Does it fall apart easily (loose consistence)?
     2. Is it soft or hard? (doesn’t form clumps or breaks into smaller chunks)
     3. When damp, is it loose? (falls apart) friable? (breaks apart with a little pressure) or firm? (needs a lot of pressure)
     4. When wet, is it sticky? Is it “plastic” (can you mold it?)
  2. Record all observations

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| Soil Sample | Loose/soft/hard | Damp descriptor | Wet descriptor |
| Clay |  |  |  |
| Sand |  |  |  |
| Outside sample ?? |  |  |  |

* 1. Observe your soil for structure
     1. Rub the dry soil between your fingers
     2. Does it fall apart into roundish lumps or angular clumps?
     3. Observe under a stereomicroscope and sketch the structure of the particles (Rounded? Platy? Granular? Angular?)
  2. Record all observations

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| --- | --- | --- |
| Soil Sample | Clumping structure | Sketch of particles |
| Clay |  |  |
| Sand |  |  |
| Outside sample ?? |  |  |

Conclusions:

How would you describe your “outside sample”? In terms of your observations so far, what is it most similar to? (use your data in your answer!)

Day 2: Bulk Density

Purpose: T o determine the density of clay and sand and compare to a given sample

Hypothesis: How do you think your soil will compare?

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Notes on:

* Density – M/V
* Bulk Density

Materials:

Clay sample

Sand sample

Humus sample

Given soil sample

Plastic cup

Graduated cylinder

Scale

Funnel

Procedure: Write your own procedure, numbering all steps. Hint – break up all clumps of soil!!

Data table:

|  |  |  |  |
| --- | --- | --- | --- |
| Soil Sample | Volume | Mass | Density |
| Clay |  |  |  |
| Sand |  |  |  |
| Humus |  |  |  |
| Outside sample ?? |  |  |  |

Conclusions: How does your sample compare?

Day 3-4:

Purpose: To compare the permeability and rate of absorption of sand, clay, humus, and a soil sample.

Hypothesis: What type of material will allow water to move through at the fastest rate? The slowest rate? How will your soil sample compare?

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Notes on:

* Capillary Action
* Permeability

Materials:

4 plastic cups

Clay sample

Sand sample

Humus sample

Soil sample

8 squares of cheesecloth (about 7-8 cm square)

4 plastic columns (both ends open)

Sharpie marker

Scale

Paper toweling

Graduated cylinder

4 plastic vials

A timer

4 rubber bands

Procedure:

1. Obtain samples in the plastic cups
2. Lay the plastic columns side-by-side and measure up 7 cm from the “bottom.” Make a mark with the sharpie.
3. Secure a double-layer of cheesecloth over the bottom of each of the plastic columns. Trim the cheesecloth so that you can easily see the soil. Make sure that the mark is still 7 cm from the bottom end!
4. Weigh each empty column and record in the data table
5. Fill one of the columns to the mark with clay, being sure to break up all lumps beforehand.
6. Fill the other columns with sand, humus, and your given soil sample (again, being sure that all lumps are broken up.)
7. Weigh the columns containing dry samples and record in the data table.
8. Put 10ml of water in each of the plastic vials
9. Get the timer ready
10. Place the cylinder of sand into one of the vials and time how long it takes for the water to travel up the column by capillary action
11. Record in the data table.
12. Repeat steps #9-11 with each of the other samples (you may run them at the same time if you are careful with the timer!)
13. If the column is not completely saturated by the end of the class period, record the height to which the water has risen and the time it took to get that far. Estimate how much longer it would take to reach the saturation level.
14. Add a little more water to each vial (maybe another 15-20 ml) and leave them to stand overnight.
15. NEXT DAY!!
16. Remove the soil columns from the vials and hold them until the dripping stops.
17. Weight the columns and save them for the next test.
18. Be sure the data table is complete.

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| --- | --- | --- | --- | --- |
|  | Clay | Sand | Humus | Soil |
| Weight of empty column |  |  |  |  |
| Weight of column and dry soil |  |  |  |  |
| Weight of dry soil |  |  |  |  |
| Weight of column and saturated soil |  |  |  |  |
| Weight of the water |  |  |  |  |
| Water-holding capacity (g H2O/ml soil (need bulk density from day 2!) |  |  |  |  |
| Distance travelled by water (in mm) | 70 | 70 | 70 | 70 |
| Time required for water to travel the above distance |  |  |  |  |
| Rate (mm/time) |  |  |  |  |

**Be sure to save the saturated soil columns for the next day!**

Conclusions:

Which type of material holds the most water? How does your soil sample compare? In which type of material does water move the fastest and slowest? How does your soil sample compare?

Day 4

Purpose: To compare the wet and dry permeability of of sand, clay, humus, and a soil sample.

Hypothesis: What type of material will allow water to move through at the fastest rate? The slowest rate? How will your soil sample compare?

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Materials:

Same as yesterday, plus 8 twistie-ties

Procedure:

1. Keep the saturated columns of the 4 samples; clay, sand, humus, and soil.
2. Create 4 new columns, one of each exactly the same way as yesterday.
3. Use the twisty-ties to suspend all 8 columns in vials
4. Get the timer ready.
5. Pour 10ml of water into the dry sand column.
6. Time how long it takes for the first drip to come out.
7. Record
8. Time how long it takes for the last drop of water to soak in.
9. Record
10. Repeat for all of the columns.
11. Record all times

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| --- | --- | --- | --- | --- |
|  | Dry soil | | Wet soil | |
| Time for the first drop | Time for entire sample | Time for the first drop | Time for the entire sample |
| Sand |  |  |  |  |
| Humus |  |  |  |  |
| Clay |  |  |  |  |
| Soil sample |  |  |  |  |

Conclusions:

Describe your soil sample as it compared to clay, sand, and humus…